

Client Meeting 1 Minutes

- Discussion of deliverables
 - Virtualization of 5 different control system scenarios
 - Lightweight, portable VMs
 - Devices
 - “leaf”
 - Relay
 - Should be real-time (how?)
 - PLC
 - 2nd level: Control-level device (like SEL RTAC)
 - 3rd level: Networking devices
 - Switches: just needed at the host level? (for multi-host machines)
 - Security device (firewall, gateway)
 - Start with one substation (about 10 relays, 1 gateway, etc.) for our demo
- Step 1: research existing virtual devices
 - How accurate are they to the real world?
 - What exists?
 - Next step? (finalize requirements and prep for design.)
- Display
 - Visualization would be nice.
- Hosting: internal GitLab instance
 - Probably open source release in the future
- No confidentiality issues with *our* part of the project
- Any (reasonable) programming language(s)
- Documentation requirements
 - Partially handled through
 - Docs for specific devices
- Basic stuff (beta) by about March would be good.
- No need for automated setup yet

Client Meeting 2 Minutes

- Next meeting: 26th or 1st
- Discussed existing virtual devices
 - Possibly add
- Continued goals
 - Find specs for controllers
 - SEL/Siemens would be good options.
 - May need to throttle controller performance to match “real hardware”
 - Focus is on the GUI interface.
- Preview goal (right before winter break)
 - Gateway
 - Network
 - No need to handle serial communication
 - Relay device with data model
 - Some kind of supervisor or control device
- Joseph: ask about previous virtualization project
- Getting data into relays
 - Opal RT?
 - Build sims directly into relays? (may be simpler...)
 - “Pluggable” data model (Shared library? Process & pipes?)
 - Could integrate with Opal too.
 - How does the relay respond to a trip?
 - Continued voltage measurements or just zeroes?
 - Ask Dr. Johnson.
- Arrange tour of a substation?
- Stretch goal: whole-system “monitor” interface

Client Meeting 3 Minutes

2017-11-01

- Moving from standalone servers to Amazon AWS instances
 - Make sure all team members have access.
 - Document the process of deploying a container.
- Virtual relay
 - Discussed progress
 - Values can be reported as integers (in volts, amps, and degrees)
- Control device
 - Reviewed existing (limited) design; should be sufficient for the prototype
- Licensing: whatever PNNL legal approves
- Design review
 - Probably November 15th at around 2:30 or 3:00PM.
 - Diagrams
 - Amazon integration stuff
 - Rough timeline
- Wiki
 - We'll try to get Pacific Project logo usage rights.

Client Meeting 4 Minutes

2017-12-05

- Change of model — integrating building automation
 - Existing building automation model becomes new focus
 - We'll need to package OpenPLC.
- Scheduling substation tour
 - Jan. 23 or 25 — 3:30PM
 - We should provide a combined team schedule to know when we're all available.
- Expo poster
 - Can be printed at PNNL
 - Provide a file about 2 weeks ahead
- Prototype
 - Basically something with an IP address that can be plugged into the network
- Next meeting time
 - Tues./Thurs. after MLK Jr. Day
- Possibly working with a grad student on some stuff

Client Meeting 5

2018-01-31

Status updates

- Will receive a data usage agreement
- Trying to do both electrical and building automation

Design review

- Probably next Friday (but not at 1:00 PM)
 - Joey will talk with Bruce.

Tasks: between now and end of semester

- Note: Expo is in late April.
- Virtual relay
 - Start using “real” input data.
- Docker Swarm
- Documentation
- HMI
- VPN for internal network access

Data handling

- Mostly CSV-formatted

Client meeting 6

2018-02-23

- Showed off existing prototypes (VPN, HMI, etc.)
- Discussed future integration
 - We'll want to see if we can set up Docker containers with a bridge into an external network.
 - Definitely work on documentation!
- Design issue: how do we make containers aware of each other's IP addresses?
- Final code deployment: hosted internally at PNNL
 - Internal container registry?
 - Needs feedback from PNNL IT.

Client meeting 7

2018-04-12

- Status of major components
 - Mostly ready
 - Router/switch
 - Expand documentation
 - Options
 - Docker internal (with overlay network)
 - Existing physical/virtual devices
 - Research (and document!) macvlan networks.
 - IP address handling (DHCP and/or static IP)
- Expo
 - When is presentation? (Notify Jessica.)
 - Stuff to do before:
 - Use actual data for demo
 - Tweak relay to use timestamps instead of fixed interval?
 - Relatively low priority; intervals should be fixed anyway.
 - Start preparing poster (will need to be printed early)
- Legal
 - Will get information via email on what license we'll be using
- Container registry
 - We'll need to set up an internal Docker registry since the network will be air-gapped.
 - Script to automatically build all images?
 - We'll need to make sure we have a way to configure the registry name!

Instructor Meeting 1 Minutes

- Discussed current progress
 - Mostly blocked by limited client contact
- Showed system diagram

Meeting 1 Minutes

2017-09-11, 6:00PM

- Reviewed contract
- Initial client meeting: arranged (Joseph)
 - 3:00 on Thursday the 14th
 - Conference room reserved
 - Will discuss instructor meeting after; might be possible right after client mtg.
- JIRA (Dillon): license process started; should be ready soon
- Reviewed earlier discussions with client
 - Virtual devices and ModBus/DNP3 communication
 - Likely focused on C/C++
 - Some specs exist for virtual devices to build.
- Discussion of architecture
 - Likely based on Docker containers
- Made agenda for next client meeting

Assignments

- All: develop some high-level familiarity with ModBus, DNP3, and containerization

Future tasks

- Finalize last bits of contract

Meeting 2 Minutes

Monday, 2017-09-18, 6:00PM

- Revised contract for smaller team
- What are our goals right now?
 - Review existing simulation systems for relays and RTAC-like devices
- Discussed structure of Docker and how we would use it
- Discussed items for next client meetings

Assignments

- All: research virtual devices
- Gabe: relays
- Joseph
 - Contact PNNL about server access
 - Look into control machines
 - Schedule next client/instructor meeting
- Ben
 - Prep diagram of Docker structure
 - Set up GitLab/Jenkins
 - More research on OpenPLC

Meeting 3

Monday, 2017-09-25 6:00PM

Review

- Research results
 - Joseph: DNP3 information
 - Control systems: pretty standard Linux boxes
 - Any special programming language support?

Goals/tasks

- Build infrastructure prototype

Assignments

- Ben
 - Get PNNL server access
 - Set up infrastructure
 - Use gateway as a test case?
- Continue research (all)

Meeting 4 Minutes

2017-10-02

Review

- No word from client about server/meetings
- Found a relay datasheet

Discussion

- Reviewed upcoming deadlines

Assignments

- Ben
 - Update portfolio
 - Add data sheets I've found
 - Follow up on server again?
- Gabe
 - Look at RTAC data sheets
- Joseph
 - Confirm next client meeting

Meeting 5

2017-10-09

Review of goals/tasks

- Snapshot day
 - Assembled snapshot materials
- PNNL server
 - Still waiting

Design

- Discussed design of virtual relay program

Assignments

- Ben
 - Wait on server
 - Consider relay design further
- Joseph
 - Take snapshot poster to campus

Meeting 6

2017-10-16

Review of goals/tasks

- Snapshot: not bad, but next time:
 - More color
 - Bigger poster
- Reviewed design process for virtual relay

Design

- Discussed thread architecture of virtual relay
 - Do we really need a separate input simulation thread?
- Some discussion on future goals
 - Use WireShark to show Modbus communication? (if we don't have a viewer)

Assignments

- Joey & Gabe
 - Contact EE prof.
 - Ask client about server progress
- Ben
 - Work on input model and thread handling for virtual relay

Meeting 7

2017-10-23

Review of goals/tasks

- Reviewed existing relay code
 - Rename compile-time configuration namespace
- Walked through Debian VM setup

Design discussion

- Control device architecture
 - Dockerized Linux container
 - Probably a Python/Flask Web app for the user interface
 - OpenPLC for PLC functionality?
- Discussed plans for design review
 - Mostly making slides/diagrams

Assignments

- Ben
 - Clean up existing relay code
 - Expand doc comments
- All
 - Play with OpenPLC & Python Modbus bindings
 - Review existing relay code
 - Make plans for design review
- Joey
 - Follow up with client

Meeting 8

2017-10-30

Review of goals/tasks

- Wiki page started
- Next meeting scheduled
- State of relay code
 - Control logic and “input glue”

Design discussion

- GitLab CI instead of Jenkins
- Structure of relay code
 - Overall structure is OK.

Assignments

- Ben
 - Build out “input glue”
 - Expand docs and comments
 - Double-check invariants on `Connection.receive()`
- All
 - Control device Web server research
 - Python + Modbus + Flask

Meeting 9

2017-11-06

Review of goals/tasks

- Wiki page is up.
- Minor updates to virtual relay code
- Need a schedule
 - End of semester: virtual relay & basic control device
 - Relay still needs input & control logic
 - Next semester (about 3 weeks each)
 - PLC
 - Gateway
 - Multiple host machines
 - Polish & tooling (refine docs; make convenience scripts if necessary)

Design discussion: transitioning to AWS

- Played with ECS, but plain EC2 instances are probably a better option.
- Start using Alpine Linux for Docker image bases (instead of Debian)
 - Reduces image size so it's faster to push images
- Reviewed previous design (translates well to AWS)
- Virtual networking: use Docker container networks in swarm mode with DHCP/DNS
- We can prototype in our own individual AWS accounts to prevent billing issues.

Assignments

- Ben
 - More work on AWS setup
 - Initial setup script
 - Possibly refine virtual relay
- Gabe
 - Choose a Python Modbus library.
- Joey
 - Officially schedule design review
 - Start on design review slideshow
- All
 - Review wiki

Meeting 10

2017-11-13

Review of goals/tasks

- Design review slides
 - Reviewed. Looks good.
- Virtual relay
 - Basically ready to implement input code
- AWS + Docker
 - Added setup instructions
 - Tested virtual networking

Assignments

- Ben
 - More virtual relay & Docker stuff
- Joey & Gabe
 - Flask app

Meeting 11

2017-11-27

Review of goals/tasks

- Virtual relay
 - Working on code to let clients update trip status (about 50% complete)
 - Need data from client
- Control/HMI device: working on initial setup of Flask dev environment

Design discussion

- Relay control “protocol”
 - Write to holding register 0
 - 0 — hold state
 - 1 — trip
 - 2 — reset

Snapshot day

- Get bigger board? (probably not necessary)
- Mention fast deployment scripts?
- New timeline

Assignments

- Joey
 - Snapshot poster
 - Finish wiki page
- Ben
 - Continue virtual relay code (manual trip/reset and input plugins)
- Gabe
 - Work on control/HMI device

Meeting 12

2017-12-04

Review of goals/tasks

- Virtual relay
 - User-side control is working; plugin support is started.
- HMI
 - Rough mockup started

Upcoming events

- Meeting w/ client: tomorrow @ 2:30
- End-of-semester deliverables
 - Logbooks
 - Portfolios
 - Wiki page
- Probably not meeting during finals week

Assignments

- Joey
 - Update wiki
- Ben
 - Work on relay input plugins
 - Update portfolio a bit
- Gabe
 - Work on HMI mockups

Meeting 13

2018-01-22

Review of goals/tasks

- Joey
 - Finished Expo registration
 - Contacted client
- OpenPLC
 - Built basic Docker image
 - Can load startup code from a pre-defined location
 - OpenPLC code is a bit ugly, but it *does* work.
- Relay research (Gabe)
 - Use RabbitMQ for communication *between* relays (for electrical modeling)?
 - Will have to consider real-time issues
 - Look at architecture of Amazon's IoT platform?

Assignments

- Joey
 - Plan regular meetings with Dr. Bolden
 - Look at Python Modbus
- Gabe
 - Work on HMI
- Ben
 - Try to make the virtual relay code more generic?
 - Make sure client has access to all code
 - Send out a link to all GitHub projects

Miscellaneous

- Considering moving weekly meetings to somewhere on campus

Meeting 14

2018-01-29

Review of goals/tasks

- Joey
 - Started setting up instructor meeting
 - Meeting with client at 1:00 PM on Wednesday
 - Looked at PyModbus
- Gabe
 - Progress on HMI — reads configuration file and displays interface
- Ben
 - Refactored relay code

Design discussion

- Discussed Docker and Modbus topics for the next stage of implementation
- Brought up RabbitMQ — should we mention it in our design review?

Upcoming goals/tasks

- Detailed design review
 - Probably next week

Assignments

- Joey & Gabe
 - Start integrating the HMI with the virtual relay.
- Ben
 - Outline some topics for the detailed design review.
 - Look into Docker Swarm setup?
 - Refine documentation

Meeting 15

2018-02-05

Review of goals/tasks

- Virtual relay
 - Need to fix a bug — some kind of race condition?
- HMI
 - Has a Docker container now
 - Looked at prototype
 - Reviewed project structure
- VPN
 - Started key generation tool
 - Note: we'll have to consider how DNS will work over the VPN.
- Documentation
 - Noted improvements to be made (special thanks to Gabe for reviewing)

Upcoming goals/tasks

- Design review
 - Reviewed outline
 - Will meet Thursday @ 10:45 to practice presentation

Assignments

- Joey
 - Make design review presentation from outline
 - Contact instructor & client
 - Schedule a room for the design review
- Ben
 - Fix virtual relay bug
 - Update virtual relay architecture diagram
 - Update Docker diagram (gateway location)
- Gabe
 - HMI & Modbus
 - Work on documentation “holes”

Meeting 16

2018-02-12

Review of goals/tasks

- Detailed design review went well.
- Virtual relay
 - Fixed some bugs

Design discussion

- HMI: Data handling for different device types
 - JSON-based specification

Assignments

- Ben
 - Docker Swarm (at least documentation)
 - VPN key generation
 - CSV input: make plans for implementation.
- Joey
 - Update wiki
 - Make notes on pyModbus?
- Gabe
 - Tweak HMI (interaction with relays)

Meeting 17

2018-02-26

Review of goals/tasks

- PyModbus documentation
 - Make sure we use the *active* fork of the project.
 - We'll use only synchronous I/O.
- VPN is currently working.
- Virtual relay: started on CSV data input

Design discussion

- Network discovery tool
 - Allows containers to know about other containers on the network
 - Docker image? (good for a constantly running service)
 - Standalone Python script? (simpler for a "one-shot" operation)
 - Probably start with this option.
 - Made diagram (see logbooks)

Preparation for Snapshot Day

- Diagrams
- Demo (with video for backup)
- Update project learning
- Update timeline w/ detailed list of tasks

To complete before Expo

- Virtual relay data input
- Documentation!
- HMI
 - Interaction with relays
 - Automatic configuration
 - Hosting at PNNL?
 - Bridging to external networks?

Assignments

- Joey
 - Network discovery tool
 - Diagrams for snapshot
 - Wiki update
- Gabe
 - HMI
- Ben
 - Virtual relay CSV input
 - Portfolio updates (including project learning)
 - Documentation

Meeting 18

2018-03-05

Review of goals/tasks

- HMI
 - Communication with relay works.
 - Still need to convert to use AJAX.
- Relay: CSV input is working.
- Updated diagrams and project learning

Snapshot Day (tomorrow!)

- Print portfolio pages
 - Maybe add a project learning page about Flask.
- Demo: working HMI with a relay
- Update poster board

Design discussion

- Discussed how to inject container configuration files with Docker volumes
 - Discussed integration with network discovery tool and HMI configuration

Goals/tasks

- Ben
 - Print portfolio pages
 - Prepare demo for Snapshot Day
 - Work on documentation
- Gabe
 - Expand project learning for Flask
 - Work on HMI
- Joey
 - Print diagrams
 - Work on network discovery script

Meeting 19

2018-03-19

Review of goals/tasks

- Documentation: updated (mostly)
- Network discovery script: started

Design discussion

- Network discovery script
 - Probably name devices after the hostnames that Docker gives them
 - Match containers by Docker service name
 - Use `client.services(name).tasks()[n]['NetworkAttachments']` to get network parameters.

Assignments

- Joey: network discovery script
- Gabe: HMI
- Ben
 - Multi-host testing
 - Internal DNS server?

Meeting 20

2018-03-26

Review of goals/tasks

- Network discovery script (in progress)
 - Issues w/ container discovery through the service API
 - Will need a way to reload containers after reconfiguration
- Docker Swarm multi-host testing
 - Note: we'll need to mirror configuration files from the discovery script to the other nodes!
- DNS server: working (with a few minor hiccups)
- HMI: some additional features
 - Automatic refresh of device display
 - Split configuration files

Upcoming events

- Wiki page review (tomorrow @ 4:00 PM)

Assignments

- Ben
 - Help with network discovery script
 - Figure out file distribution
 - Polish relay
- Gabe: update HMI documentation
- Joey
 - Update wiki page
 - Work on network discovery script

Meeting 21

2018-04-02

Review of goals/tasks

- Network discovery script
 - Discussed current issues
- Virtual relay: finished TODO items
- Cluster file sharing: using SSHFS

Design discussion

- Discussed how to properly handle the need to have Docker volumes at absolute paths
 - Just put stuff in `/opt/pnnl_vcs` on all nodes.

Assignments

- Gabe: HMI
- Joey
 - Set up next client meeting (started)
 - Network discovery script
- Ben
 - SSHFS testing & docs
 - Network discovery: detect non-running tasks.

Meeting 22

2018-04-12

Review of goals/tasks

- SSHFS testing: done
 - Discussed pros/cons of using SSHFS
 - Have HMI just reload config on every request?
- Network discovery script
 - Still need to detect non-running tasks.
 - Re-architect file output

Goals before Expo

- Poster
- Updates to:
 - HMI (config reloading)
 - Discovery script

Assignments

- Joey
 - Discovery script
 - Plan sketch
 - Wiki: update testing docs.
- Ben
 - Docker registry
 - Networking
- Gabe
 - HMI & docs

Meeting 23

2018-04-16

Review of goals/tasks

- Testing: working on bare-metal Debian
 - Documentation “holes”: Joey has noted and will update.
- Docker registry: coming along
- Other tasks from last meeting: still in progress

Assignments

- Ben
 - Finish Docker registry
 - Start network documentation (macvlan networks, etc.)
- Joey
 - Network discovery script: refactoring
 - Poster
 - Wiki updates
- Gabe
 - HMI
 - Poster

Meeting 23

2018-04-21

Review of goals/tasks

- “Bare-metal” testing
 - Some issues with HMI image
- Discovery script
 - Progress
 - Maybe use service labels instead of image names.
- Docker Registry
 - Should be working and documented
- Networking docs
 - Some progress
 - Probably finish after EXPO

Upcoming goals/tasks

- EXPO presentation
 - We'll meet in the next couple of days.
- OpenPLC testing
 - Should probably test Modbus master stuff and expand documentation.

Assignments

- Ben
 - **Get demo ready for EXPO!**
 - Ideally, record a video in case things break.
 - Test OpenPLC with QModMaster.
 - Documentation cleanup
 - Iron out network bridging (start)
- Gabe
 - New logical structure diagram
- Joey
 - Draft new slideshow
- All
 - Prepare presentation

Meeting 23

2018-05-21

Final tasks before HMI

- All: design report
- Ben
 - Update docs
 - Network stuff
 - Tar file with all repos
- Joey
 - Final wiki updates
 - Burn CD
 - Discuss plans with lead instructor
 - Final report
 - Confirm deliverables
- Gabe
 - HMI documentation
 - Print diagrams for portfolio